SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, AUGUST 12, 1904.

CONTENTS:

Inaugural Address of President Charles Richard Van Hise 193

The University of Montana Biological Station and its Work: PROFESSOR MORTON J. ELROD 205

Scientific Books:—
Reade on the Evolution of Earth Structure: PROFESSOR FRANK D. ADAMS. *The Crosby-Brown Collection of Musicians' Portraits:* C. K. WEAD 212

Scientific Journals and Articles 214

Discussion and Correspondence:—
The Biological Survey of the Waters of the Pacific Coast: PROFESSOR WM. E. RITTER. *Professor Taguchi's Brain-weight:* DR. EDW. ANTHONY SPITZKA 214

Special Articles:—
Variae Auctoritatis: DR. C. R. EASTMAN .. 215

Botanical Notes:—
Ecological Plant Studies; Animals in the Plant Kingdom; A Flora of Pennsylvania: PROFESSOR CHARLES E. BESSEY 217

Agriculture in Japan 218

The Urban and Rural Population of Great Britain 219

The Carnegie Trust for the Universities of Scotland 220

Scientific Notes and News 221

University and Educational News 224

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

INAUGURAL ADDRESS OF PRESIDENT CHARLES RICHARD VAN HISE.

"And ye shall hallow the fiftieth year. . . . A jubilee shall that fiftieth year be unto you."—*Leviticus*, XXV: 10 and 11.

UPON behalf of the regents and faculty I thank the hundreds who have come here to join in the jubilee of the University of Wisconsin. We are delighted to welcome our guests from all parts of the United States, from Canada, from Europe, and from other parts of the world. Among the honored guests are official representatives of universities, academies and learned societies, of museums and libraries, bearing the congratulations of the institutions which they represent. That the chief learned institutions of the United States, a considerable number of foreign institutions, and many renowned scholars should regard this jubilee as of such consequence as to wish to take part in it, should encourage the state to continue to support and further to develop its university.

Fifty years ago the instructional force of the very small college here situated, even then called the University of Wisconsin, consisted of four members—three professors and one tutor. That year there were in attendance 56 students, all men, of whom only 41 were of collegiate grade. At that time the only building on the ground was old North Hall. This building still stands to give evidence of the architectural taste of those who designed it. Even in these early days Chancellor Lathrop and other men who controlled the policy of the university had visions of the

future. A wide avenue was laid out from the head of State Street to the crest of University Hill. Upon one side of the avenue, somewhat down the slope, was placed North Hall, it being planned to build a South Hall at the corresponding place upon the other side, and to locate the main building of the future university upon the crest of the hill. The dreams of the men of this time went even further than this, their plans providing for four dormitories. Later structures, and all succeeding plans, have left free the broad avenue above State Street, and the three buildings—North, South and University Halls—stand at the places assigned them by the men who, in their minds, created these structures before the foundation of any was laid.

At the end of the college year of a half century ago two students were graduated, Charles T. Wakeley and Levi Booth. We hoped the latter would sit upon the platform to-day as a guest of the university, but in the midst of his preparations for the long journey from Denver he was stricken with a serious disease. We deeply sympathize with him in his misfortune and hope for his speedy recovery. Upright and influential in the community in which he lives, a leader in his chosen vocation, we recognize him as a type of the thousands who since 1854 have been granted the degree of this university.

The morning is too far advanced to permit a narrative of the development of the University of Wisconsin from the time it bestowed its first blessing upon Charles T. Wakeley and Levi Booth. Many of us have read of, and some of those here knew of the struggle first for existence and, later, for advancement, during the twenty years from 1854 to 1874.

At the beginning of this period Chancellor Lathrop was still president; then followed the two years' incumbency of Chancellor Barnard; the headship of Professor Sterling for six years; the presidency of Paul Chadbourne for four years; and the four years' term of President Twombly. During these years great progress was made, with exceeding slowness and difficulty at first, haltingly always, but still progress. South Hall and University Hall, planned by the adventurous thoughts of the leaders of the early days, were built. Slowly recognizing that in a state university there must be no distinction between the sexes, the authorities of the university constructed Chadbourne Hall and gradually admitted women to all the privileges of the university. Substantially the same relations which now obtain between the high schools and the university were established, the certificates of high schools being accepted by the university, thus linking together in one unbroken chain the various branches of state education. The departments of law, agriculture and engineering were started. Finally, in 1872, the state, confessing that it had frittered away the university land-grants in order to attract settlers to Wisconsin, recognized its obligation, and gave to the university financial support to the extent of $10,000 per annum. This sum was small, but it was of profound significance as marking a fundamental obligation of the state, the ignoring of which would have delayed for many years the growth of the university, if it would not have indefinitely condemned the institution to obscurity. At the end of this period of twenty years the faculty consisted of 29 members; the students, exclusive of the preparatory class, numbered 310.

While the dawn of prosperity may be said to have appeared between 1870 and 1874, this latter year marked a new epoch in the university, for then came John Bascom, of Williamstown, Mass., as our presi-

dent. His administration continued for thirteen years, from 1874 to 1887. Preparatory work was now cut off, and transferred to the high schools. The College of Letters and Science, in these earlier years called the College of Arts and Letters, became consolidated and unified. Strong courses in the liberal arts were built up. While instruction in law and the applied sciences of agriculture and engineering increased somewhat, these subjects were still of very subordinate importance. During the administration of Dr. Bascom the instructional force increased from 29 to 49, the college students from 310 to 505. At the beginning of this administration there was one so-called resident graduate and at the end there were three. These advanced students mark the dawn of graduate work. During President Bascom's administration Assembly Hall and the first Science Hall were built. A few years later the latter was destroyed by fire; but so rapid had been the development of science in the university, that it was necessary to replace this building by a larger and better Science Hall and to provide separate buildings for chemistry and shop work.

Of deep significance with reference to the future was the fact that during these years ex-Governor C. C. Washburn, a man who had gained his fortune in the Northwest, gave a portion of this wealth to the university in the form of Washburn Astronomical Observatory. For more than twenty-five years this institution has been of inestimable advantage to students of science, and one of the important centers of productive scholarship at the university. It has thus helped to make the university known, not only in the state, but throughout the nation and the world. But, perhaps, most promising of all with reference to the future, was the action, in 1876, of the state legislature, which levied a continuing one tenth of a mill tax for the support of the university. In 1883 this tax was increased to one eighth of a mill and in later years the state grants have been further increased from time to time. Thus the state became committed to permanent and liberal financial support of the university.

While the alumni of the time of John Bascom remember with delight their student days, while they retain much that they then acquired, while they place above price the intellectual attainments which have enabled them successfully to deal with the world, probably for many of them the most treasured remembrance, the most potent influence which they carried away from the university, was the pervasive, mastering, moral power of John Bascom, whose personality wrought itself during his presidency into every graduate. The men of the days of Dr. Bascom may, or may not, now believe the tenets of his formal philosophy and ethics as given in his books, and as pounded into them in the class-room with sledge-hammer blows, but they believe and share in his high ideals, are inspired by his burning enthusiasm, and have thus been led to stand steadily for the right.

Following the administration of Bascom came that of President Chamberlin, from 1887 to 1892. During these years the new Science Hall was completed, the Law Building was constructed, and an appropriation was secured for a gymnasium. The instructional force increased from 50 to 68; the students from 505 to 1,092. The graduate students increased from 3 to 22. The work in law, agriculture, and engineering, which had been mere adjuncts to the study of liberal arts, received organization as colleges. This perfected the present organization of the university into Colleges of Letters and Science, of Engineering, of Agriculture and of Law.

A distinctive feature of Chamberlin's administration was the recognition of the importance of applied science. The profound necessity for raising the ancient art of agriculture to a science, in order that the land shall yield its fullest return, and that the occupation shall be dignified and ennobled, was fully appreciated. It was also seen that in this age, in which the world is for the first time being taken possession of by man, advance is largely in the hands of the engineer.

But, perhaps, of even greater significance than the development of applied science was the emphasis placed by Chamberlin upon scholarship and research—a definite attempt on his part to make the institution of which he was the head justify the name of university. To this end the system of university fellowships was established, scholars and investigators were added to the faculty, and the small beginnings of what, during the present year, became a graduate school appeared. The profound influence of this movement was not limited to the advancement of knowledge. It was equally important in the diffusion of knowledge. The man who is so full of enthusiasm for his chosen subject that he will burn his brains for its advancement is an inspiring teacher. He is the man who illuminates the knowledge of a thousand years ago with the discovery of to-day.

Following Chamberlin's administration came that of Adams from 1892 to 1901. On account of the ill-health of Dr. Adams, for the last two years of his administration, the charge of affairs was largely in the hands of Dr. Birge, and, after Dr. Adams's resignation in 1902, Dr. Birge was acting president until 1904. During these twelve years the gymnasium was finished, the large group of agricultural buildings, including Hiram Smith Hall, the Horticulture-Physics building and Agricultural Hall, were constructed. And, crowning all, by the joint efforts of the Historical Society and the university, the superb state library building arose, little short of the perfection of the structures of the ancient models. This building stands as a permanent and powerful influence for the promotion of the beautiful and appropriate in architecture.

During the twelve years' administration of Drs. Adams and Birge the instructional force increased from 68 to 180, the number of students from 1,092 to 2,877, and the graduate students from 22 to 115.

The applied sciences of engineering and agriculture rapidly developed during those years toward their true proportionate position in the university. The course in commerce, which may be called a course in applied arts, was organized. This course was at once a conspicuous success.

The rapid rise of applied education in the university during the administrations of Chamberlin and Adams alarmed some persons, who feared that the influence of the liberal arts was thereby endangered. As a matter of fact, during Chamberlin's administration the number of regular undergraduates in the College of Letters and Science increased from 217 to 711, and during the following twelve years to 1903, excluding those in commerce and pharmacy, from 711 to 1,232. During these same seventeen years the number of graduate students increased from 3 to 119.

In education, as in industry, when a fortunate development takes place which meets a need, it finds students adapted to it. Were it not for the courses of applied education in the university, it is safe to say that about 1,000 students now here would be somewhere else, and it is also certain that if technical education had nowhere developed in this country, a large proportion of this 1,000 students would never have entered a university. If one but compares the very slow increase in

the number of students at Oxford, where the old curriculum has remained largely intact, with the rapid increase in the number of university students where applied education has developed, he will not doubt the correctness of these statements. Applied education is mainly fed by a new constituency. While applied education may attract a few students, who otherwise would have gone into the courses of liberal arts, the tremendously increased momentum of the educational movement produced by the large numbers that flock to the universities probably has brought to the liberal arts more students than have been lost to it by the rise of applied knowledge.

While all this is true, it is fortunate that in this university the College of Letters and Science became so firmly established before agriculture and engineering were developed. So strong are the liberal arts and pure science, that I have no fear that the College of Letters and Science will lose its leading position in the university. For this college the union of the great Historical Library, the University Library and the Wisconsin Academy Library is most fortunate. This superb joint library is doing for the liberal arts what the various science buildings with their equipment have done for the pure and applied sciences, affording opportunity for the highest grade of work, an opportunity utilized by the students in those departments in which men of university caliber occupy the chairs. As evidence of the increasing power of the College of Liberal Arts is the recent growth of graduate work, the students in which, with few exceptions, are in the College of Letters and Science.

During the current year the schools of economics and political science, of history, of pharmacy, of education and of commerce, which had been organized under the administrations of Chamberlin and Adams, have been merged in the College of Letters and Science. These changes place all of the economic work done in the university in the Department of Political Economy; all of the botanical and chemical work heretofore done in the School of Pharmacy under the Departments of Botany and Chemistry, respectively. The purpose of the change is to correlate the work in these various lines with the work in the liberal arts, thus unifying the College of Letters and Science without weakening its various courses in any way. The courses in commerce and in pharmacy now have the same relation to the other courses of the College of Letters and Science, that the courses in civil engineering and electrical engineering have to the course in general engineering. The graduate work of the university, being located in all of the colleges and representing their culmination, has been organized into a school.

The catalogue of the present year shows an attendance of 3,150 students, and an instructional force of 228, while this commencement there will be conferred in course 361 degrees, of which 334 are bachelors, 17 masters and 10 doctors. If we contrast these numbers with those of fifty years ago, an instructional force of 4, 56 students and 2 baccalaureate graduates, is it surprising that we should cry: 'and ye shall hallow the fiftieth year. . . . A jubilee shall that fiftieth year be unto you'? And with our joyfulness there is a profound feeling of thankfulness to the state that has had the wisdom to be guided by men of such breadth of view as to provide liberally for the education of its children and of all others who care to share its educational hospitality.

While the achievements of the past fifty years are sufficiently great for celebration, the ideal of the state university is still more worthy of celebration. A score of years ago it could not have been said of

any state in America, that it had shown willingness to support a university of the highest class; but now several state institutions are recognized as standing in the first group among American universities. These institutions are mainly supported through taxation imposed by a democracy upon itself, for the sons and daughters of the state, poor and rich alike. Until this movement of the state universities had developed, the advantages of all educational institutions of the highest rank in all countries had been restricted to one sex, and even now it is practically impossible for the sons of artisans and laborers to enter the doors of many. In state institutions, where education is maintained by the people for the good of the state, no restriction as to class or sex is possible. A state university can only permanently succeed where its doors are open to all of both sexes who possess sufficient intellectual endowment, where the financial terms are so easy that the industrious poor may find the way, and where the student sentiment is such that each stands upon an equal footing with all. This is the state university ideal, and this is a new thing in the world.

The older universities of America have developed from small colleges. The earlier colleges of the United States were modeled upon Oxford and Cambridge. We turn for a moment to these institutions, in order to understand the nature of their influence upon the American university. If one were to name the most fundamental characteristic of these English institutions, it would be the system of halls of residence, involving commons, unions and athletic fields. The communal life of instructors and students in work, in play and in social relations is the very essence of the spirit of Oxford and Cambridge. It might almost be said that this constitutes Oxford and Cambridge. So fundamental have the English regarded the system that, from time to time, when the students have become too numerous for accommodation in existing quadrangles, another college has been founded upon the pattern of the others. If one were to consider the modern demands upon a university and especially the demands for wide opportunity to study science, pure and applied, he could scarcely imagine a more antiquated system than that represented at Oxford and Cambridge. Indeed, the old system has failed to meet the new conditions, and Cambridge especially is being rapidly modified under them, the various colleges contributing jointly for laboratories in pure and applied science, which may be utilized by the students of all the colleges. But, in making these radical changes, there is no thought of abandoning the halls of residence, with their communal life. Rather than surrender these, the authorities would, I believe, give up all modern lines of work. The college system of Oxford and Cambridge may seem absurd, but for some reason these universities have produced an astonishingly large proportion of great statesmen, writers and scientists. The men of Oxford and Cambridge have been largely instrumental in extending the empire of Britain over the earth; they have contributed liberally to the greatest literature of the world; they have furnished many fundamental ideas to science. In view of these stupendous results we need scarcely wonder that the Englishman is not eager to make over Oxford and Cambridge after the Yankee or the German model.

In the early days of the University of Wisconsin, when the only college buildings were North and South Halls, when Professor Sterling, his family, several instructors and a majority of the students lived in these halls, we had the essentials of the English system. Even when President Bascom came here in 1874 the remnants of the system still existed. Many of the men,

a majority of the women and a number of the instructors lived in the dormitories. In 1884 came the disastrous fire which destroyed the first Science Hall. There was urgent necessity for lecture rooms and laboratories to carry on the instructional work of the institution. Without any definite plan to change our system, indeed without any thought of the profound change which was being made in the character of the university, the students were turned from the dormitories, and halls of residence for men at Wisconsin were abandoned.

I have no doubt that every one of the alumni here, who in the old days lived in North or South Hall, feels that this change, although possibly necessary at the time, was most unfortunate. The professor in the class-room and the laboratory can do much for a student, and especially he can do much if he believes that one of the highest functions of a professor is that of a comrade. But, when the student goes out into the world, there is no other part of his education which is of such fundamental importance as capacity to deal with men, to see the other fellow's point of view, to have sympathetic appreciation with all that may be good in that point of view, and yet to retain firmly his own ideas and to adjust the two in fair proportion. Nothing that the professor or the laboratory can do for the student can take the place of daily close companionship with hundreds of his fellows. In the intimate communal life of the dormitories he *must* adjust himself to others. He must be genial, fair, likable, or else his lot is rightly a hard one. This fundamental training in adaptability to and appreciation of his fellows can only come from attrition between a large number of human units. These are the reasons, understood without statement by Englishmen, which make them adhere to the Oxford and Cambridge system. These are the reasons, profoundly comprehended by Cecil Rhodes, which led him to leave his entire fortune to establish the Rhodes scholarships at Oxford for the Teutonic race, knowing as he did from experience the influence of the communal life of Oxford in molding a world-conquering man. Believing, as he did, that the Teutonic people are to control the destinies of the world, he was deeply anxious that many of the best of the youth of Africa, Australia, Canada, Germany and America should gain the Oxford point of view.

Harvard, Yale, Princeton and Pennsylvania, originally modeled on the English university, and suffering under no accidental disturbance, have retained many of the features of this system to the present day. If the University of Wisconsin is to do for the sons of the state what Oxford and Cambridge are doing for the sons of England, if it is to do even what the eastern institutions are accomplishing for their students, not only in producing scholars and investigators, but in making men, it must once more have halls of residence, and to these must be added a commons and a union. At the commons the men meet one another each day; at the union they adjourn for close, wholesome, social intercourse. The union should be a commodious and beautiful building, comfortably, even artistically, furnished. When the students are done with their work in the evening, the attractive union is at hand, where refreshments may be had, and a pleasant hour may be spent at games, with the magazines, in a novel, or in social chat. The coarse attractions of the town have little power in comparison.

But, to build adequate halls of residence, commons and a union will require large sums of money. What more fitting thing for wealthy men of the state, who have gained their riches by taking advantage of its natural resources, than to turn back to the state some portion of their wealth for

this most pressing need? In no way can a man leave a more appropriate and permanent monument for himself than by building a hall of residence, a commons or a union. The state of Wisconsin is a safer trustee than any individual or corporation. The man who attaches his name to a hall, a commons or a union will fix that name as one to be loved in the minds of the unnumbered sons of the state that during the centuries to come will flock to the University of Wisconsin to obtain intellectual training, to develop high ideals, and more than all, to gain sterling, vigorous, self-sufficient, adjustable manhood. May I not hope that before the end of this jubilee year the money will be forthcoming to provide for these needs, so that the necessarily very large demands upon the state may be restricted to supplying additional buildings, equipment and instructional force made imperative by the extraordinary increase in number of students at the university?

We have now very briefly sketched the effect of *one* of the influences of the English upon the American university, but there remain other influences to be considered. The original American college was essentially a counterpart of the English college; indeed, this was true well into the nineteenth century. But, in the second half of that century, important American modifications appeared to better adapt the college to our needs. Perhaps the most important of these was the development of pure science and its assimilation by the college of liberal arts. This radical change met a much more ready welcome in the west than in the east. For a long time in the east science was regarded as an intruder, and was only slowly and partially admitted to full fellowship with the studies of the old curriculum. When science was finally, grudgingly, given a place in some of the more important institutions, it was made an appendix to the college, and in a number of cases a new name was attached. This is illustrated by the Lawrence and Sheffield Scientific Schools. In the west science did not receive separate foundations, although the courses in which science was the major line of work were at first kept separate from the old course in which the classics and mathematics dominated. A new degree was given for science, which, for many years at least, was regarded as inferior to the A. B. degree. To the present time in some institutions of the east the distinction between work in science and work in the old curriculum is retained; and in one the organization of the college and the scientific school are so nearly independent that the college has introduced science into its courses, thus duplicating much of the work of the school. And in another, where the separate organization of the classical college and the scientific school is more or less formal, different degrees are granted in the college and in the school, without regard to whether the subjects pursued by the students receiving the different degrees are the same or not. In the state universities where the college and school of science were never made separate foundations, and where with the great increase in number of subjects, freedom of election has been introduced, it has become recognized either that there should be a separate degree for every group of studies, or else one degree for any group of liberal studies. This latter alternative has been accepted by the leading state universities, and, in this respect, it is believed that they are leaders in educational progress, although not pioneers, for Johns Hopkins led the way. No one now doubts the right of pure science to full admission to the list of subjects which may be pursued for a liberal education. Not only so, but it is recognized that the scientific spirit has permeated and vivified the studies of the old college course.

Scarcely less noteworthy than the winning of a place for pure science in the university has been the rise of the great groups of studies classified under political economy, political science, sociology and history. From a very subordinate, almost insignificant, place in the curriculum, they have risen to a place not subordinate to classics or science.

The development of these subjects in the universities is destined to have a profound influence upon governmental progress. In the university men are trained to regard economic and social questions as problems to be investigated by the inductive method, and in their solutions to aim at what is best for the whole people rather than at what is favorable to the interests with which they chance to be connected. Such of these men as are filled with a burning enthusiasm for the advancement of the race, are capable of great accomplishment, for they possess the enlightenment upon which wise action may be based. Already men who have studied history, economics, political science and sociology in the universities have achieved large results in the formulation and enforcement of the written law, and in the growth of a healthy and powerful public sentiment. Soon such men will be found in every city and hamlet, leading the fight against corruption and misrule; but, even more important and vastly more difficult, leading in constructive advance. In these men lies, in large measure, the hope of a peaceful solution of the great questions deeply concerning the nation, some of which are scarcely less momentous than was that of slavery.

But the western people were not content with the expansion of pure knowledge. They demanded schools of applied knowledge. This demand was early recognized in this and many other universities by the organization of law schools, which deal with subjects closely concerning each individual. So important is the subject of the law that these schools of applied knowledge were very early established and their subsequent development has been uninterrupted.

After science found its way into the universities, a natural, indeed an inevitable outcome of its admission into the institutions supported by the states demanding both culture and efficiency was the rapid growth of the applied sciences, of which the more important are agriculture, engineering and medicine. But the people of the west went even further than this and demanded that language, mathematics, political economy and history should be so taught as to serve the man of affairs, and thus there arose here the first strong course in commerce in the United States. Such a course has now been introduced into a number of other institutions, including one of the principal universities of the east. Whether one deplores or approves the rise of applied knowledge in the universities, it is an inevitable movement which, for my part, I expect to see extended. In the recognition of the intellectual power gained by pursuit of applied knowledge and its extreme importance in the development of the nation, the state universities of the west have been at least abreast of the eastern institutions.

From the foregoing it is plain that the most important American modifications of the English college system have been the introduction and development of pure science and applied knowledge. While these modifications represented a great broadening of the classical college, they did not produce a proportional increase in the height of the edifice of knowledge.

This leads us to another influence upon the American university, which has profoundly modified it—the German influence. Some thirty years ago Johns Hopkins, at Baltimore, left his fortune to found a university, and Daniel C. Gilman was called

as its first president. President Gilman saw an opportunity for a new type of institution in America. Having visited universities abroad, he became convinced that the great need was for a university upon the German model, where investigation and the production of scholars should be the dominating ideas. The ablest scholars at home and abroad were invited to fill the chairs of Hopkins. The success of this new type of institution in America was almost instantaneous. Not only did Hopkins soon become a chief center of research in this country, but it sent scores of men with Hopkins training as professors to other universities. Even earlier than the foundation of Hopkins, a steady stream of students was returning to America from German universities, bringing with them the German spirit. After the foundation of Hopkins this stream increased rapidly in size. The students trained at Hopkins and in Germany could not fail to influence the more important institutions of the country. There slowly appeared upon the stronger of the old colleges a superstructure.

This upward movement was more quickly felt in the east than in the west, but, even in the west, here and there, a scholar in the state universities appeared who was not content to do instructional work alone. At Wisconsin the first of these were Allen and Irving. Chamberlin, an investigator, believing in research in state universities, when he became president at Wisconsin, began systematically to develop scholarship and research. Other state universities have gone through similar stages of growth. Thus both in the east and in the west the graduate school has arisen upon the college, and its influence permeates all parts of the university. But the growth of the graduate school in the American university has been slow. The cost of such a school, relative to the number of students within it, is large, and it has been assumed that the state universities especially must not go too far in the development of such a school. No mistake could be so fatal to the power for good of the state university. In Germany, where the universities mainly devote themselves to the class of work done in the graduate school, the universities are, without exception, supported by the government. The German statesman regards it as a matter of course—as settled beyond dispute—that the production of scholars and investigators at the university is a necessity to the nation. To them, he believes, is largely due the great position which Germany has taken during the last half century. It was after the disasters of the Napoleonic wars that the German educational system was reconstructed, at the top of which was the university. The rise of the university has been correlative with, and one of the chief causes for, the rise of Germany.

If time permitted, I should be glad to consider the effect of university work upon the mind of the student, that is, work in which he takes a share as an investigator and during which he acquires the spirit of research. It would be easy to show that the qualities of mind gained by such work are those which best fit him for the struggle of life—which best fit him to handle difficult business, social and economic problems. In Germany the university scholar is a man of affairs. He is found in all important divisions of administration. Almost every prominent German and Austrian professor is an official adviser to the government. Already, in America, we see the beginning of this movement. University professors are asked to serve on tax commissions, in the valuation of railroads and in various other capacities. Within the next half century the number of such men in these and similar positions will increase many fold. The college-trained man,

and especially the university-trained man, is, directly or indirectly, to control the destinies of the nation.

But while the professor performs important service outside the university, his greatest service is his own creative work and the production of new scholars in the laboratory and seminary. I unhesitatingly assert that there is no investigation of matter or force or mind to-day in progress, but to-morrow may become of inestimable practical value. This could be illustrated by various investigations which have been made here. It is easy to show that the discoveries at the University of Wisconsin bring vastly more wealth to the state each year than the entire expenditure of the institution, but to tell of them might seem like placing too great emphasis upon our own achievements, and I, therefore, turn elsewhere for illustrations.

Scarcely more than a century since, Franklin began studies upon the nature of lightning. Later the character of electrical force was during many years investigated with remarkable power by Faraday. If, during these studies, some one had said: 'Of what practical value can be the discoveries of Franklin and Faraday?' no one could have given the answer. Had this work been paid for by the state it would have been easy to show to the legislature that such a foolish waste of money was wholly unwarranted. But out of the discoveries of Franklin and Faraday, and those who followed them, has come one of the greatest material advances that the world has known. Electricity has become the most docile of the forms of energy. It serves to carry to distant points the power of Niagara. It is the nerves which make all the world one body, which bring to us instantaneously all the happenings in every quarter of the globe, which puts in our ear the vibrations of the voice of our friend a thousand miles away. Through increased knowledge of nature the peoples of all nations are being made slowly, haltingly, with occasional disastrous wars, into one family. And this is largely the result of recondite studies upon subtle forces, which, even now, we can not define, but which we can utilize.

A striking case of the profound service of the investigator is furnished by the studies of Pasteur and Koch. If, a half century since, a legislator in France had wished to be humorous at the expense of the scientist, what better object of derision could he have found than his countryman, Pasteur, who was looking through a microscope at the minute forms of life, studying the nature and transformations of yeast and microbes? And yet, from the studies of Pasteur and Koch, and their successors, have sprung the most beneficent discoveries which it has been the lot of man to bestow upon his fellow men. The plague and cholera and yellow fever are controlled; the word diphtheria no longer whitens the cheek of the parent; even tuberculosis is less dreaded and may soon be conquered; aseptic surgery performs marvelous operations which, a few years ago, would have been pronounced impossible. The human suffering thus alleviated is immeasurable.

These illustrations are sufficient to show that no knowledge of substance or force or life is so remote or minute, although apparently indefinitely distant from present practise, but that to-morrow it may become an indispensable need. The practical man of all practical men is he who, with his face toward truth, follows wherever it may lead, with no thought but to get a deeper insight into the order of the universe in which he lives. It can not be predicted at what distant nook of knowledge, apparently remote from any practical service, a brilliantly useful stream may spring. It is certain that every fundamental discovery yet made by the delving student has

been of service to man before a decade has passed.

Already at Wisconsin here and there a scholar has arisen whose most elemental thought is to see deeper into the order of nature. Let the university search well for such spirits and give them unbounded opportunity, for they are to be benefactors, not only of the state, but of the entire earth; for a new truth, a new principle, is not the property of any state, but instantly belongs to the world. May men of creative power, trained by Wisconsin, leave our doors in ever-increasing numbers, until they become a great enlightening influence in the state and the nation! The final and supreme test of the height to which a university attains is its output of creative men, not in science alone, but in arts, in literature, in ethics, in politics and in religion.

I, therefore, hold that the state university, a university which is to serve the state, must see to it that scholarship and research of all kinds, whether or not a possible practical value can be pointed out, must be sustained. A privately endowed institution may select some part of knowledge and confine itself to it, but not so a state university. A university supported by the state for all its people, for all its sons and daughters, with their tastes and aptitudes as varied as mankind, can place no bounds upon the lines of its endeavor, else the state is the irreparable loser.

Be the choice of the sons and daughters of the state, language, literature, history, political economy, pure science, agriculture, engineering, architecture, sculpture, painting or music, they should find at the state university ample opportunity for the pursuit of the chosen subject, even until they become creators in it. Nothing short of such opportunity is just, for each has an equal right to find at the state university the advanced intellectual life adapted to his need. Any narrower view is indefensible. The university should extend its scope until the field is covered from agriculture to the fine arts.

The barrenness of America in the creation and appreciation of literature, music and art is the point upon which Europe charges us with semi-barbarism. If the university does not become the center for the cultivation of the highest capacities of the human mind, where is the work to be done in this country? In America there is no other available agency. This work must be undertaken by the university, or else remain undone.

If the people of the United States are to cease being mere money getters, if they are to accomplish more than material advance, if they are to have proportional development, the university must give opportunity for training in all lines of human endeavor.

If the University of Wisconsin is to do for the state what it has a right to expect, it must develop, expand, strengthen creative work at whatever cost. Only by so doing is it possible for the university to serve the state in the highest way. For my part, I look forward with absolute confidence to the liberal support by the state of a school whose chief function is to add to the sum of human achievement. I am not willing to admit that a state university under a democracy shall be of lower grade than a state university under a monarchy. I believe that legislatures elected by all the people are as far-sighted as legislatures that represent an aristocracy. A great graduate school will be realized at some state university during this century. Is Wisconsin to have this preeminent position?

We are now able to suggest the ideal American university—one which has the best features of the English system with its dormitories, commons and union; one which includes the liberal and fine arts and the additions of science and applied science; and one which superimposes

upon these an advanced school modeled upon the German universities, but with a broader scope. In such a university the student in the colleges of liberal and fine arts has opportunity to elect work in applied science, and thus broaden his education. He feels the inspiring influence of scholarship and research, and thus gains enthusiasm for the elementary work because it leads to the heights. The student in applied knowledge is not restricted to subjects which concern his future profession, but he has the opportunity to pursue the humanities and the fine arts, and thus liberalize his education. He, too, feels the stimulus of the graduate school, and, if one of the elect, may become an investigator and thus further ameliorate the lot of mankind by new applications of science to life. The student in the graduate school, primarily concerned with creative scholarship, may supplement a deficient basal training by work in the liberal arts and in the schools of applied knowledge. Thus the college of liberal arts, of applied knowledge and of creative scholarship interlock. Each is stronger and can do the work peculiar to itself better than if alone. This combination university is the American university of the future, and this the University of Wisconsin must become if it is to be the peer of the great universities of the nation.

Wisconsin is among the state universities which have this opportunity open to them. Many of the states have divided their grants among several foundations, supporting at different localities, schools of liberal arts, of agriculture, of medicine and of mining. In Wisconsin there is only one institution which attempts to do university work. Public and private funds alike, which are to go to a university, should come to that institution. This statement does not imply lack of appreciation of the excellent and very important work done by the colleges of the state. May they continue to thrive; may they continue to have the support of the citizens of the state; for the many thousands of students that during the next half century are continuously to demand a college education in this state can not be accommodated in one institution. Collegiate work should be done at several centers within the state, but professional and university work is so expensive and the different schools and colleges so closely interlock, that the best opportunities can only be furnished in the various fields in the university. At a university of the first rank the opportunities for instruction in the fields strongly covered are superior to those which can be offered in an institution devoted to a single field. Wisconsin has fortunately escaped the fatal mistake of subdivision of its university effort. With the concentrated support of the state, public and private, there is no reason why the University of Wisconsin should not do in every line as high grade work as any in the country. My faith is such that I look forward with confidence to the future, with profound conviction that the breadth of vision, which has enabled this institution to grow from small beginnings to its present magnitude, will continue to guide the state, until a university is built as broad as human endeavor, as high as human aspiration.

THE UNIVERSITY OF MONTANA BIOLOGICAL STATION AND ITS WORK.

THE University of Montana Biological Station at Bigfork, on Flathead Lake, opened its sixth annual session on July 18, the session lasting for five weeks. The circular giving announcement of the work for the season contains a number of new and choice original photographs, giving views of the region in which the station is located, including sketches of Flathead

Lake, the forests adjacent and the mountains in the vicinity.

This station was started in 1899 as an experiment, in a state as large as Ohio, Pennsylvania and Michigan combined, with less than two inhabitants per square mile, and with biological study at a low ebb in the schools of the state. It was intended to fill the double mission of affording a place where a few might find suitable place for carrying on study in a field comparatively unknown, and to supply a stimulus for the teachers and young naturalists, few of the latter having at that time yet appeared.

It is practically impossible for Montana people to attend eastern summer schools. One reason is on account of railroad expense. At present writing rates are advertised from Chicago to San Francisco and return by a different route at identically the same price as from Missoula to San Francisco and return, and at the same price as one way fare from Missoula to Chicago. For a few days in June one may get out of the state at a low fare. But Chicago students may visit Flathead Lake with little more expense for the return trip than return trip from Lewistown, Mont., by taking advantage of reduced rates. Moreover, the summer is the pleasant time for one to be in the mountains, and most people wish to stay during the pleasant season. Owing to the fact that railroads grant few privileges to Montana people, and Montana people wish to stay at home during the most pleasant portion of the year, it seemed advisable to look toward preparing a place at home where advantage could be taken of beautiful scenery, healthful recreation and balmy mountain air, in a locality where 'unknown' is written on half the objects that greet the eye.

The station has accomplished more than was anticipated at its inception five years ago. The small summer laboratory has long since ceased to accommodate the work of those in attendance. But, owing to the delightful weather prevailing at this season, it matters little whether the work be carried on indoors or not, unless table room and apparatus are needed. Students from twelve states have been present at different times, in addition to the many that have come from Montana. Already the schools of the state are feeling the effect in the work in zoology and botany, not only through the attendance of high school and grade teachers, but through the material which is collected and the printed matter prepared for distribution.

The printed matter thus far issued by the University of Montana, emanating from the work at Flathead Lake, covers 360 printed pages of close type, with 65 plates and 40 other illustrations, all from original photographs or drawings. In addition to this, numerous papers have appeared in various publications, greatly increasing the scope of the work.

The study of the birds of the Flathead Lake country has been carried on by P. M. Silloway, the well-known ornithologist. The first publication included 128 birds. This study has been carried on continuously for four seasons, usually from June until September. A second contribution increased the list to 137, which includes the summer residents and a few early fall migrants. This careful systematic work is especially valuable in making a good beginning in the study of the birds in a region not well known. The careful oological notes are full of interesting observations. Frequent references are made to calamities befalling old birds or their young. It is shown that birds occupy unfinished nests, which contain eggs. This may be due to the laziness or shiftlessness on the part of the mother, or to her inexperience, which

prevents rapid working, or to the destruction of a first nest. The finding of a nest of the willow thrush, which ordinarily builds close to the ground, six and one half feet up in a tree, will be of interest to students of animal intelligence, as illustrating the change of habit due to environment. The region in which the nests occur may overflow annually.

Among the interesting notes concerning the distribution of Montana birds, that of the occurrence of the varied thrush, *Hesperocichla nævia* (Gmel.), is of importance. This songster heretofore has not been reported east of the Coeur d'Alene Mountains in Montana. It was found in abundance at the head of Swan Lake, and by reliable observers in the neighborhood it was reported to be a permanent resident and one of the earliest in nidification. The olive-backed thrush, *Turdus ustulatus swainsonii* (Cab.), was found in numbers at the head of Flathead Lake, though in equally advantageous localities seventy miles farther south it was scarcely represented. At Selish, on the Jocko River, we noted the long-tailed chat, *Icteria virens longicauda* (Lawr.), abundant in numbers and in full song, though we were too early for the nesting season. A small colony of Holboell's grebe, *Colymbus holboellii* (Reinh.), was found nesting on Swan Lake, and several sets of eggs, in complements of three, four and five eggs, were taken. Specimens of pigeon hawk, *Falco columbarius* Linn., Richardson's Merlin, *Falco richardsonii* Ridgw., pygmy owl, *Glaucidium gnoma* Wagl., pileated woodpecker, *Ceophloeus pileatus* (Linn.) and the like were taken.

Principal Silloway is now pushing his ornithological investigations in other directions, to regions not visited by ornithologists, with the idea of later preparing a work on the birds of the state.

The biological station is favorably situated for carrying on work in plant ecology lines. This is due to the fact that within a radius of ten miles there are several different climates, giving rise to different plant formations. The west side of the valley at the head of Flathead Lake and the Mission valley at the south end of the lake have little rainfall, and a typical prairie vegetation is the result. Kalispell, situated in the prairie, has a rainfall of about sixteen inches per year. The east side of the valley has a greater precipitation and a forest formation results from this. Columbia Falls, situated at the base of the mountains on the east side of the valley, has a rainfall of a little over twenty-one inches per year. This town is only a short distance from Kalispell. The mountains near the station are very accessible, so that alpine conditions can be easily studied.

The botanical work done in the summer of 1902, by Harry N. Whitford, was entirely along forest ecology lines. A map was made comprising some 96 square miles, which are situated mostly in the forest formation, but reach into the edge of the prairie. Five well-defined plant societies were noted. These are distinctly related to the amount of water in the soil, and that in turn depends mainly on the topographic diversity. The hydrophytic societies are closely associated with a great amount of water in the soil. They are located along streams and around lakes, and have plants in them resembling very much those in similar situations in the eastern part of the United States.

The mesohydrophytic societies are usually adjacent to the meadows. Because the Engelmann spruce is the principal tree in these they are called the Engelmann spruce societies. Other trees associated with the spruce are the narrow-leafed cottonwood,

the aspen and the white birch. Bordering the Engelmann spruce stands are the western larch-Douglas spruce societies, so called because they are the predominating trees. The western larch-Douglas spruce type of a forest is decidedly mesophytic. In places where the soil contains nearly as much water as that in the spruce society, the silver pine (*Pinus monticola*), the lowland fir (*Abies grandis*) and the western arborvitæ are found. The lodge-pole pine is scattered all through the mesophytic area, sometimes forming almost pure stands in it. There is but little doubt that its presence in the region is due to the influence of forest fires. It is a tree that fruits well at an early age. This gives it a decided advantage over the other trees, because when frequent fires occur it is likely to be the only one with fruiting trees on the burned areas.

In places in the forest formations there are 'sandy pockets.' These are likely to have prairie vegetation. The absence of trees is probably due to the fact that the sand is not capable of holding the water sufficiently long to enable trees to get a start. Closely associated with these 'sandy pockets' and bordering the prairie formation are the bull pine-Douglas spruce societies. The bull pine (*Pinus ponderosa*) is the most xerophytic of the conifers and thus extends further out into the prairie region than any of the others.

A collection of the other plants of the region was made and their ecological distribution was noted. This collection has been deposited in the herbarium of the Field Columbian Museum at Chicago. Careful studies were not undertaken in the alpine regions, though in hasty trips made into these regions some problems were noted for future studies.

Extensive botanical collections were made in 1901. The station and the New York Botanical Garden worked conjointly during the season from June to September, Dr. D. T. MacDougal and Wilson P. Harris gathered nearly a thousand numbers, the latter looking particularly after the lichens and mosses. The lichens have been identified by Carolyn W. Harris, the mosses by Mrs. Elizabeth G. Britton. Duplicates are in the collections of the University of Montana and the New York Botanical Garden. A check list of lichens and mosses has been issued, giving twenty genera and sixty-seven species of lichens and nineteen genera and thirty-seven species of mosses, a total of thirty-nine genera and one hundred and four species.

The collection of flowering plants was gathered from territory much of which had never been visited by a botanist. The Mission range, fast becoming known on account of its grand scenery, was examined almost from end to end, a distance of nearly a hundred miles. The valleys at the base of the range are from 2,300 to 3,000 feet elevation, while the summits reach 10,000 feet. Excursions were made with pack horses into the Swan range, where specimens were gathered from snowbanks and the edge of glaciers. The alpine willow was found abundantly at 7,500 feet, the stunted trees, but a few inches in height, bearing flowers. Days were spent in crawling over steep mountains, with a heavy pack as an encumbrance, without road or trail, in search of specimens. The large series shows the result. Each number was taken in duplicate, one set being deposited in the herbarium at the New York Botanical Garden, the other at the University of Montana at Missoula. The identifications were by P. A. Rydberg, the well-known authority.

Some observations on the forests are worthy of notice. The alpine fir, *Abies lasiocarpa* (Hook.) Nutt., is found at a

low elevation, certainly as low as 3,000 feet. A few scattering trees are found on the banks of Swan River near the laboratory, while forests of this species may be seen at the upper end of Swan Lake. Here the trees are large enough for logging. A tree at 3,000 feet elevation aged 120 years was one third larger in diameter than one aged 200 years at 7,500 feet. The age of the largest trees at elevations about 7,500 feet is about 200 years.

The alpine pine, *Pinus albicaulis* Engelm., takes the place on the higher slopes of the yellow pine, *Pinus ponderosa* Laws., on the lower levels. The yellow pine is the pioneer, pushing out into the dry and unoccupied valleys, preparing the way for those species requiring more moisture. The alpine or white-barked pine can not tolerate moisture. It is practically absent in the protected amphitheaters at high elevations, leaving the alpine fir to hold full sway. The alpine pine takes the dry slopes, exposed to the sun, or the rocky ridges where soil is scanty and where existence is had by the severest struggle. It prefers a narrow and storm-swept ridge, or a dry and scorching slope, to the quiet, protected, but damp slope. Its gnarled, twisted and broken trunk is in marked contrast to the tall, tapering and stately alpine pine on the opposite side of a ridge, but a few rods away.

The lodge-pole pine, *Pinus murrayana* 'Oreg. Com.,' is a follower of other species. After the yellow pine, tamarack, or Douglas spruce has made a dense forest, making a rich and damp soil, a fire may clear the forest. Then the lodge-pole springs up, as thick as it can stand. The region adjacent to the laboratory shows this, where tall boles of monster tamaracks or yellow pines, amidst dense masses of younger lodge-poles, tell a mournful tale of magnificent forests but recently laid waste. Its ability to produce cones in a single year, coupled with the early maturity of the tree, six or seven years, gives the lodge-pole a firm hold on the soil. But it is its own destroyer, since it is intolerant of shade and may be squeezed out again by more hardy rivals. How many successions of species of forest trees there may have been will never be known. The evidence points to three in recent times: Yellow pine —Douglas spruce, tamarack and lodge-pole.

Extensive collections have been made of the fresh-water invertebrata of the western end of the state. By means of a canvas boat the soundings of mountain lakes have been made, and the life of the waters gathered for future study. These soundings and dredgings have been made during the past five summers, and much material and information has accumulated as the result. Lakes hitherto called bottomless are known definitely. Flathead Lake, covering more than three hundred square miles, has at no place a depth of more than three hundred feet. Enough work has been done to prove that at some seasons of the year the entomostraca have a decided diurnal or nocturnal movement, ascending to or toward the surface at night or during cloudy weather, descending when the sun shines. The depth to which they descend is from twenty-five to thirty feet. This corresponds almost exactly to the limit of vision when the white net is lowered into the clear and blue water. Again, for some unknown reason, certain species seek the surface during the hottest weather and brightest sunshine, when they may be dipped up with a tin-cup. *Daphnia thorata* Forbes was exceedingly abundant in 1901, when Forbes made his visit to the region, but at no time in the five years' collecting have we found it in large numbers. There is much room for study of the plankton of the region, and the waters at such varying

elevations, lakes at 3,000 feet and others at 9,000, offer a fine field for the limnobiologist. A few seasons of collecting during the summer whets the appetite for more extended study during the entire season.

A number of observations on the geology of the country have been made, suggesting fruitful fields for more extensive study. It has been shown conclusively that the northern end of the Mission range has been smoothed by the action of ice, a smaller mass from the south meeting a larger field from the north, the latter deflecting the former directly back—southward, but on the opposite side of the Mission range. It has been shown that the old bed of the Swan River was northward along the base of the Swan range, where it emptied into the Flathead near Kalispell, whereas it now empties into Flathead Lake at the northeastern corner.

Much of the surface geology of the Flathead and Mission valleys has been determined. It has been shown beyond doubt that the present outlet of Flathead Lake is comparatively new, and that the former outlet was through the western arm, near Dayton Creek. The present level is several hundred feet lower than the former level, the new outlet uncovering the rich valley at the head of the lake. The moraines at the foot of the lake and at other places in the Mission valley on the Flathead Indian Reservation have been brought to light and partially described. The moraine at the foot of the lake is four hundred and fifty feet high, and many miles long. It has not been followed westward. From the lake one rises by a steep wagon road to the summit, descending on the opposite side to a plain lower than the lake.

Incidentally shells have been gathered from various portions of the state. While few mollusks are to be expected from a region of rushing rivers and cold lakes, with small amount of lime in the water, yet the collection is very satisfactory and the number of species for the state is growing. The entire list for the state numbers but sixty species and varieties. Of these twenty-five have been collected west of the main range of the Rockies, forty-two from the eastern slope. Seven are found on both sides of the range. One new species and several new varieties have been described. No collecting for shells has been made along the Missouri or its tributaries except at Wibeaux (by Homer Squyer), on the extreme eastern border. The wide territory along the Missouri has not yet been touched.

In entomology extensive collections have been made, principally of the lepidoptera. Only the diurnals have been determined. These show that the butterflies of the northwest are in much confusion, and the study is beset with great difficulties. The life history of a large number is as yet 'unknown.' Indeed, this stares one in the face on almost all occasions, wherever he gathers material in the state. So interesting did the study of these airy insects become that a systematic report has been prepared and is now in press. This report will include photographs of all the specimens obtainable, with keys for identification. It is based on the collections of the writer; of Earl Douglas in the Ruby Mountain and the Madison range; of Professor R. A. Cooley, of Bozeman; of E. N. Brandegee, of Helena, and of the late C. A. Wiley, of Miles City. It lists about one hundred and twenty-five species. A few points may here be mentioned. *Parnassius smintheus* seems to be scarce at higher elevations in the western end of the state, but is often abundant at 4,000 feet, and has been taken on the shore of Flathead Lake, 2,900 feet. *Vanessa J. album* is

credited in all works as being everywhere scarce. It has been taken at Swan Lake by the hundreds, a dozen being taken in the net at a time. *Anosia plexippus* is scarce in the western slope. The milkweed has but lately been introduced along the railroads, and its numbers are increasing annually. But it is yet rare. Its mimic, *Basilarchia disippus,* has been taken at Gold Creek, on the Northern Pacific, where the last spike was driven, about fifty miles west from the summit of the range. It has not been taken further west. There is no doubt but that *Argynnis Edwardsi* and *Argynnis nevadensis* are synonyms, as shown by specimens from various localities, and by specimens in the Wiley collection and that of the writer, identified by Edwards himself. At Missoula butterflies were on the wing in 1903 as early as February 19, when *Vanessa californica* was taken. The cosmopolitan *Pyrameis cardui* is to be taken everywhere, while *Pyrameis atalanta* is very rare west of the range. As the state contains portions of four faunal areas, the Great Plains, the Hudsonian or Canadian, the Great Basin, and the Boreal, a diversified entomological life is to be expected. There are certainly many Pacific forms that have followed up the Columbia River and its tributaries. Indeed, it seems that the Pacific forms may have more invertebrate representatives in the western part of the state than those from the great basin. At any rate, many additional facts on distribution are recorded.

The dragon flies, numbering less than sixty species, about one half as many as are to be found in New York state, have been determined, and are in manuscript. One species, *Calopteryx yakima,* considered by Calvert to be synonymous with *C. æquabilis* from the eastern side, has been found at Flathead Lake. Years ago Hagen described the species from specimens taken at Lone Tree, near the Yakima River, Washington. He believed that it crossed the range from the east at some point 'above' (north of) Missoula. The finding of the species proves the soundness of his reasoning, and brings the species very close to the main range. It also confirms Calvert's view of the relationship between the eastern and western specimens. Further reference to this insect will be found in *Bulletin University of Montana,* Biological Series, No. 3.

Among the various collections that have been made at the station may be mentioned the splendid series of photographs. These have been taken at all altitudes from the level of Flathead Lake to the 10,000-foot summits. They show various geological and physiographical studies and formations of the mountain ranges, and serve to illustrate the changes that have taken place during ancient and recent times. Negatives have been made of the forests, trees and flowers, of large animals, birds and insects, illustrating phases of both animal and vegetable life. Many of these negatives are exceptionally good, and make remarkably good slides. When colored they show the views quite life-like. Altogether more than a thousand negatives have been secured. From these a book of photographs has been made. From these as samples it is possible to make selections, and slides will be made for those who may be able to make use of them. The book will be sent to responsible persons for examination with a view to selection of slides.

Some of the studies here given show the charm of a new field to those who have been privileged to visit it. Numerous problems yet awaiting solution could easily be proposed. With so many lakes close by, and others not far away, the daily, monthly and annual movements of entomostraca afford ample opportunity for the limnobiologist. The alpine heights, the vast for-

ests in the Lewis and Clarke reserve, the glaciated valley, the numerous mountain chains, the unknown animal and vegetable life, suggest numerous topics for the thoughtful student.

There is no reason why eastern friends should not make the laboratory a rendezvous during the summer. One can recreate to the fullest and yet have a definite object in view. It is impossible to visit the mountains and see them without some one of experience to help the visitor around. Vacation is gone before the wanderer 'hits the trail' he is seeking. His inexperience leads him to undertake things he can not do. Montana can not be seen from the car window. One must push out of the canyons. He is unwise who enters the pathless forests alone. They are too vast, the hills are on too large a scale, and the difficulties are too great to be entered hastily.

From the laboratory the collector may easily reach alpine heights, where grand scenery is spread before him. He may gather material for future study, undertake serious study indoors, more serious and more difficult study out of doors, and have the help and wisdom of those who have spent years in wandering in search of such places as many wish to visit and such specimens as many would gladly gather. The building is entirely inadequate to the demands of those attending, but it is believed that when the merits of the station are known and its opportunities fairly presented it will not lack for suitable quarters.

The summer session opened on July 18, and continues five weeks. The illustrated pamphlet, giving full information, will be sent to any one requesting it.

Morton J. Elrod.

University of Montana,
Missoula, Mont.

SCIENTIFIC BOOKS.

The Evolution of Earth Structure with a Theory of Geomorphic Changes. By T. Mellard Reade. New York, Longmans, Green & Co. 1903.

This work may be considered as a sequel to the well-known volume entitled 'The Origin of Mountain Ranges,' by the same author, which appeared in 1886. It is divided into three parts. The first of these treats of 'Geomorphic Changes' and deals with Regional Oscillation, the Relation of Continental Evolution to Mountain Building, Continental Growth and the Sub-Oceanic Configuration of the Earth's Crust. The second part deals with the 'Dynamics of Mountain Structure' and the experimental elucidation of the same, while the third part is made up chiefly of reprints of papers by the author on subjects allied to those just mentioned, which papers have appeared at various times and in different journals.

The author first cites numerous cases where there is distinct evidence of changes of level in the earth's crust, with concomitant bending of the strata composing the crust. He considers the principle of isostacy as quite inadequate to the explanation of these movements, since the mass of the solid earth involved in upward movement is entirely too great to be explained by any sedimentation which has taken place in the same period of time. These changes of level the author believes must be due to change in bulk of certain sections or portions of the earth's crust, without change of mass; the irregularities in the earth's surface, in fact, arising from differences in the specific gravities of the earth's crust and the underlying matter. These specific gravities are not stable, but are subject to slow changes consequent upon changes of temperature. A rise in temperature and increase in volume create a protuberance; a fall in temperature, on the other hand, gives rise to a depression, even to one of those profound abysses of the ocean aptly named 'deeps.' The cause of these secular variations in temperature, however, is not set forth, although in the mind of the author it seems to be in some way connected with chemical changes taking place in

a solid globe. The very high specific gravity of the earth's interior as compared with that of the lithosphere, is believed by the author to be due to an increase in density of the materials composing the deeper parts of the earth's interior, due to pressure, and is not, according to him, to be attributed to a difference in character of these materials as is commonly supposed.

The great continental or epirogenic uplifts above referred to are not to be confused with the comparatively trivial expansions and contractions to which mountain building is due and which are dealt with by Mr. Mellard Reade in his 'Origin of Mountain Ranges,' as well as in part two of the present work. These latter are local and due to tangential 'creeps' in the lithosphere and surface rocks, which are accompanied by a lateral transfer of material from one place to another, and result from the uneven heating of great masses of sediment. The great continental movements result from alteration in volume of certain portions of the earth's crust, unaccompanied except to a minor extent by lateral movement.

These great movements, moreover, have a very important influence on the secular variation of sea level, since there can be no alteration in the contour of that portion of the surface which is covered by the ocean without a corresponding change of oceanic beach levels over the whole surface of the globe.

In the second part of the book, the author enters upon a description of the results of an experimental investigation into the forms developed in certain materials by heating and by compression. These are presented for the elucidation of the problem of the origin of mountain ranges, and represent a continuation of the results already set forth in the author's former volume on the subject. The materials employed in these experiments were varied in character. At first the action produced by alternately heating and cooling a lead plate, fixed about the edges in a solid framework, was investigated. Anticlinal folds, simple and overturned, were thus developed in the plate, which became thinner in portions of its area owing to the transference of lead to the site of the fold.

Subsequently a series of experiments were carried out on the effects of lateral compression on narrow plates of lead alternating with strips of calico and covered by pieces of board, so arranged as to leave a vacant space above the middle of the composite plate. On compression anticlinal folds of several types were developed.

Bars of soap were then compressed in a similar manner, but could not be made to bend, a fault with slickensided surfaces always developing. Alternate layers of damp sand and of sand mixed with coal dust were then tried, and again the material would not fold, but sheared, developing a double set of sharply defined overthrust faults. Layers of moist sand were then alternated with sheets of tea lead and submitted to compression in the same way. In this case the lead prevented the sand shearing, but developed a complicated series of overturned folds to which the sand accommodated itself.

A series of experiments were then carried out on the circular compression of disks of various materials, with the development of domed folds of many types, some of them showing spiral or screw-like movements, similar to those described by Mrs. Gordon in her paper on 'The Torsion Structure of the Dolomites.'

The third part of the book consists of 'Reprints, Speculations and Closing Remarks.'

Among the reprints are the author's well-known papers on the 'Denudation of the Two Americas,' 'The North Atlantic as a Geological Basin,' and a 'Theory of Slate Structure and Slaty Cleavage.' It also includes chapters on 'Time as a Geological Factor,' and on the bearing of the present investigations in the supposed permanence of ocean basins and continents, on which latter much-debated question the conclusion is reached that 'interchanges of such magnitude have occurred in the distribution of the oceans and land masses during geologic time that it would be a misnomer to call them permanent.'

The book, while containing many interesting observations and embodying much research, would be improved by a more careful elaboration of the material which it contains,

in its present form its various parts showing a certain lack of unity. It is well printed and elaborately illustrated.

Frank D. Adams.
McGill University, Montreal.

Catalogue of the Crosby Brown Collection of Musicians' Portraits. Biographical Sketches. New York, The Metropolitan Museum of Art. 1904. 8vo. Pp. vii + 131.

In the series of handbooks relating to Mrs. Brown's great collection which have received notice in Science as they have appeared this little volume is part IV. Along with musical instruments she has collected many hundred portraits of musicians; over 400 of these have been mounted, approximately in chronological order, on hinged frames, and placed in the exhibition galleries.

This catalogue gives a sketch of the life and works of the musicians whose portraits are exhibited, arranged in order of framing. It has also indexes, classified, geographical and alphabetical. It is noticeable that no American is found in the list and no living Englishman; this is doubtless largely due to the fact that photographs have been excluded except in one instance. In view of the many fine prints in the collection the addition of the names of artist and engraver would have added to the value of the work, and interested a wider circle of people in the collection.

The pamphlet does not call for extended review here; its special interest to readers of Science arises from the fact that it is a well-considered attempt to make a museum collection thoroughly intelligible to the public.

Charles K. Wead.

SCIENTIFIC JOURNALS AND ARTICLES.

The *Botanical Gazette* for July contains the following articles: W. J. Land has made an important contribution in the results of his study of "Spermatogenesis and oogenesis in *Ephedra trifurca*." Among the important results may be mentioned the occurrence of two persistent prothallial cells in the male gametophyte, no wall separating the second prothallial from the generative and tube nuclei; also the remarkable pollen chamber developed by the breaking down of the nucellar beak to the embryo sac, the necks of the archegonia projecting into the pollen chamber and coming immediately in contact with the pollen grains.—R. E. Smith presents 'The water-relation of *Puccinia asparagi*,' being a contribution to the biology of a parasitic fungus; both the direct and indirect results are discussed.—D. T. MacDougal presents a somewhat detailed account of 'Delta and desert vegetation' and shows that the region offers unusual opportunities for comparison of the most high developed xerophytic types of the desert with the broad-leaved forms of the delta which root in the mud.—J. C. Arthur has given an account of the discovery of 'The Aecidium of maize rust,' which is found on species of *Oxalis*. The communication is intended not only to announce an interesting fact, but also to illustrate a method of observation not yet commonly understood.—B. E. Livingston and G. H. Jensen have published a short statement of a somewhat striking result obtained from 'An experiment on the relation of soil physics to plant growth,' which gives somewhat conclusive evidence in favor of the view that the amount of water present in the surface layers of the soil is largely dependent upon the size of the soil particles.

DISCUSSION AND CORRESPONDENCE.

THE BIOLOGICAL SURVEY OF THE WATERS OF THE PACIFIC COAST.

To the Editor of Science: The biological survey of the waters of the Pacific adjacent to the coast of southern California recently inaugurated by the San Diego Marine Biological Association will be prosecuted continuously for a number of years. The laboratory connected with the survey, at present located at Coronado, is under the immediate charge of the resident naturalist, and is ready at all times of the year for occupancy by investigators.

The director is authorized by the managing board of the association to offer the privileges of the laboratory to biologists who may desire to visit this locality for a period in the prosecution of special researches. Such facilities

as the station possesses—which are not, as yet, extensive—will be gladly placed at the service of visiting naturalists without charge, but microscopes can not usually be supplied. It should be understood that at present the station is equipped and manned solely with reference to the survey. Any one who may contemplate accepting the invitation here extended should communicate with the Director at the University of California, Berkeley, California. The resident naturalist for the present year is Mr. B. M. Davis whose address is Point Loma, San Diego, California; and for special information relative to materials available for study at particular times, living facilities, etc., he should be communicated with.

The following are among the species of animals that may be had at any time, at certain seasons of the year, or by special efforts in collecting:

Ceratium, several species; *Thalassicolla* and other spumularia; *Acanthometron* and other Acantharia; several sponges, species undetermined; *Tubularia crocea, Corymorpha palma, Campanularia æstualis, Sertularia desmoides;* of medusæ: *Obelia* sp., *Pelagia* sp.; *Sphæronectes köllikeri; Renilla amythystina, Virgularia* sp., *Cerianthus* sp., *Edwardsia* sp., *Sagartia pedrensis, Epiactis prolifera, Anthopleura californica; Toxopneustres* sp., *Strongylocentrotus purpuratus, Lovenia cordformis, Echinarachnius excentricus, Asterias capitata, Asterina miniata, Phataria* sp.; *Ascopodaria* sp., *Bowerbankia* sp., *Crisia* sp., *Scrupocellaria* sp.; several opisthobranchs; *Bulla mebulosa, Monocerus* sp., *Cerostoma* sp., *Chiton conspicua, Pectin æquisulcatus* and *monotimeris, Octopus punctatus; Calanus finmarchicus, Eucalanus attenuatus, Acartia tonsa* and other species, *Oithona*, several species, *Phronima* sp., *Paraphronima* sp., *Euphausia splendens, Callianassa longmana, Alphius clamator* and other species, several hermit crabs; *Ciona intestinalis, Perophora* sp., *Pyrosoma atlanticum, Salpa runcinata-fusiformis, Cyclosalpa affinis, Doliolum tritonis, Oikopleura* sp., *Dolichoglossus pusillus, Tornaria ritteri; Branchiostoma californiense, Polistotrema stouti, Gyropleurodus francisci, Galeus californicus, Urolophus halleri, Fundulus parvipinnis, Typhlogobius californiensis.*

WM. E. RITTER,
Director.

CORONADO, CALIF.,
July 7, 1904.

PROFESSOR TAGUCHI'S BRAIN-WEIGHT.

TO THE EDITOR OF SCIENCE: In response to a further inquiry concerning the brain of the Japanese anatomist, K. Taguchi, the following communication was received from K. Yamagawa, president of the Imperial University of Tokio:

"In reply to your favor of May 9, 1904, I am sorry to say that the figure for the weight of brain in the last information, sent to you through Miss Gardener about the post-mortem examination of the late Professor Taguchi, was found to be wrong. It seems to me that the weight of his brain was put down as 1,920 instead of 1,520, which is the right figure, by mistake when it was copied from the original record. I apologize, etc.

K. YAMAGAWA."

The corrected figure places Taguchi's brain in the thirtieth place among those of men notable in the professions, arts and sciences, instead of second place, as first reported.

EDW. ANTHONY SPITZKA.

July 28, 1904.

SPECIAL ARTICLES.

VARIÆ AUCTORITATIS.

A PLEA for exactitude in citation of the older writers on natural history is, perhaps, less likely to be sustained than in the case of modern authors, on the ground of their being antiquated and of minor importance. Nevertheless, from an historical and esthetic standpoint, precision of reference is as desirable in the one case as in the other. It is of course less irksome and time-consuming to accept some standard authority in lieu of verifying original sources; but errors once introduced into general compilations are apt to persist indefinitely. Instances of the latter sort are to be found in nearly all compendiums of the

history of natural science, particularly those of geology and paleontology.

A few cases invite attention. One fresh at hand is furnished by Dr. S. F. Emmons's interesting address on 'Theories of Ore Deposition historically considered.'* It is remarked in one place that 'as early as Origines, 600 B. C., the observed occurrence in the rocks of casts of shells and plants was attributed to periodical floodings of the land.' Now there was one Origen, an illustrious Alexandrian theologian and founder of the science of the church; but of an Origines who lived in the fifth century B. C., history is silent. From the date assigned by Dr. Emmons it is probable that he intended to indicate Xenophanes, who commented on Sicilian fossils; or if he really had in mind one of the early Christian writers who mention them, the names of Pomponius Mela and Tertullian suggest themselves. But to make of Origen a plagiarist of Greek philosophy *malgré lui* is uncharitable, considering his defense of its study. Dr. Emmons also credits de Saussure with being the originator of the term geology. It was, however, proposed much earlier, Richard de Bury having introduced it as a special term, '*geologia*, or the *earthly* science,' in chapter xi. of his *Philobiblon*,† written one year before his death in 1345.

For another example one may refer to Dr. O. P. Hay's recent paper on Cretaceous fishes from Mt. Lebanon,‡ in which he quotes an English authority (Mr. J. W. Davis) as saying that these remains were first mentioned by Herodotus. But inquiry is made of the father of geography in vain for confirmation of this statement, though a passage indeed occurs in Book ii. relating to fossil shells of Africa. Apropos of Lebanon fishes, we notice that Dr. Hay's authority extracts an article from a Parisian newspaper relating to their discovery by the last of the Crusaders; but no mention is made of the famous chronicles of Saint-Louis, by Sire de Joinville, in which this narrative occurs.* That Voltaire was familiar with the latter can scarcely be doubted, and who knows whether it may not have been father to his sarcastic suggestion that fossils were probably nothing but the *disjectamenta* of pilgrims returning from the Holy Land?

But for the context, we might not be able to recognize under Professor Marsh's appellation of 'Albert the Great'† a celebrated scholastic philosopher of the thirteenth century, whose proper name was Albert von Bollstädt. Admirers of his learning accorded him the title of *Doctor Universalis,* envious ones called him the 'Ape of Aristotle,' though such contempt was unmerited. The name by which he is best known, Albertus Magnus, has been supposed to mean simply Albert the German. Dante refers to him, for instance (*Conv.* iii., v. 113), as 'Alberto della Magna,' la Magna—or l'Amagna—being Germany, whence also the modern Gallic equivalent. The patronymic of a well-known sixteenth century writer, George Bauer, or, in its more usual Latinized form, Agricola, has also been a source of some confusion. Even so careful a writer as L. F. Ward, for example, refers to him in his 'Sketch of Paleobotany' as Georgius Bauer Agricola.

An anachronism occurs in the statements of the last-named author, and also in those made by Marsh, Lyell and other historians of geology, regarding theories of continental subsidence attributed by them to Alexander ab Alexandro. A pre-Copernican writer, he was naturally a stranger to the heliocentric cosmogony, and it is not surprising that his 'Dies Geniales' is barren of speculations such as have been claimed for it, especially by Brocchi. It is also impossible to verify the latter's assertion that fossils are mentioned in Boccaccio's *Filocopo,* and the allusion to fossil plants

* *Bull. Geol. Soc. America,* Vol. XV. (1904), pp. 1–28.

† Mr. E. C. Thomas' translation is now accessible in the initial volume of the King's Classics (1903).

‡ *Amer. Nat.,* Vol. XXXVII. (1903), pp. 685–695; also *Bull. Amer. Museum Nat. Hist.,* Vol. XIX. (1903), pp. 395–452.

* 'Sayette' of de Joinville, the scene of King Louis' discovery, and where news of his mother's death reached him, is the old French name for Sidon.

† 'History and Methods of Paleontological Discovery' (1879), p. 7.

in 'l'Acerba,' by Cecco d'Ascoli, is of the vaguest description.

A curious misquotation occurs in the bibliography of the older literature contained in Agassiz's 'Poissons Fossiles,' where 'Les Observations sur l'histoire naturelle, sur la physique,' etc., 'an anonymous work in six volumes,' is credited to Gauthier. The title obviously refers to the journal conducted for twenty years under that name by the Abbé Rozier, and continued after 1794 as the *Journal de Physique*. The author of the alleged anonymous communication on Bolca fishes cited by Agassiz at the end of his bibliography was the celebrated geologist Albert Fortis, his correspondence with Testa having been collected and published in book form by Count Gazola in 1793 and 1794.

To devote attention to minor minutæ of this nature will no doubt be esteemed by many as 'time elaborately thrown away.' But it must be conceded that accuracy even in smaller matters possesses an intrinsic virtue, and is as well worth striving for as are the third and fourth decimal places in mathematics, *Cui bono* may not be translated into the parlance of ideal scholarship.

C. R. EASTMAN.

HARVARD UNIVERSITY,
CAMBRIDGE, MASS.

BOTANICAL NOTES.

ECOLOGICAL PLANT STUDIES.

PROFESSOR ATKINSON has recently issued a pamphlet of sixty-seven pages giving the outlines of a course of twenty-one lectures on the relation of plants to environment, delivered in the Summer School of Cornell University in 1903 and 1904. Contrary to the views of some 'ecologists,' the professor devotes a good deal of time (nine lectures) to a study of the structure of plants, under such headings as the organization of the plant, plant tissues, types of stems, foliage-leaves, root, flower-shoot, pollination, fruit and distribution, before taking up ecology proper. Under the latter appear such titles as ecological factors, vegetation types, plant migration, plant formations, forest societies, etc. While these lectures are merely outlined, it is not difficult to see that we have here a rational and logical presentation of this much-abused and generally badly taught subject.

From Professor Clements we have in the table of contents of an ecological work by him, now in press, a similar outline of another phase of the subject. This work (which will cover about 300 pages) is to be devoted to research methods in ecology, treated under four heads or chapters: (1) foundations of ecology, (2) the habitat, (3) the plant formation and (4) experimental ecology. Under the first are discussed the need of and the essentials of a system in ecology; under the second, the factors (water content, humidity, light, temperature, wind, precipitation, air-pressure, soil, etc.) and their measurement by instruments. The third chapter deals with the methods of research, the quadrat, transect, migration circle, photography, cartography and herbaria. In the fourth chapter, devoted to experimental ecology, the purpose and the scope are set forth, followed by a discussion of methods of field experiment, control experiments, comparative morphology and competition cultures. A book of this kind should go far towards correcting the looseness which has characterized too much of the work in ecology. It is to be brought out by the botanical seminar of the University of Nebraska.

ANIMALS IN THE PLANT KINGDOM.

No doubt many a botanist has felt that quite too many animal-like organisms have been included in the plant kingdom in recent years. The slime molds were originally included upon their superficial resemblance to the puff-balls, at a time when anything like a critical study of the biology of the organisms was unknown. De Bary long ago placed the slime molds 'outside the limits of the vegetable kingdom,' yet they are persistently retained in botanical manuals, and systems of plants. Thus they still hold their place in Engler's 'Syllabus der Pflanzenfamilien' in spite of his statement—'kein Anschluss an höhere Pflanzen.' Scientific consistency certainly demands their removal from the plant system. With them, also, should be cast out some much more recent animal intruders—the

Flagellatæ, Dinoflagellatæ and the *Silicoflagellatæ*, which never had any good right to be included among plants. These are the things which are happily characterized by Dr. Thaxter in a recent article in the *Botanical Gazette*, as 'a menagerie of organisms whose zoology is orthodox to a degree.'

Why the botanists should be bothered with all these 'beasts' (as Dr. Gray would have called them) is a puzzle which has not yet been satisfactorily solved. Whether the purging of the membership of the plant kingdom should go further and result in the expulsion of *Volvox* and its near allies is difficult to decide. In everything but its color *Volvox* is an animal—and a very good one at that—but whether its assumption of its green coat is sufficient to hide its essentially animal nature in other respects is, perhaps, open to argument, especially since it is such a pretty and interesting organism for laboratory demonstrations. While we should like to retain it, we are compelled to say that in all probability it is to be relegated to Dr. Gray's domain of 'beasts.'

A FLORA OF PENNSYLVANIA.

Nearly seventy years ago Dr. Thomas C. Porter began the collection and study of the plants of Pennsylvania, and until his death in 1901 he continued the work practically without interruption. At his death his manuscript was found to be essentially completed, needing only the editorial supervision of some one familiar with his ideas. Such an editor was found in Dr. J. K. Small, of the New York Botanical Garden, under whose direction the 'Flora of Pennsylvania' was brought out by Ginn, the Boston publisher. It is a synoptical flora, all descriptions of orders, families, genera and species being included in carefully made keys. Especial attention is given to habitat and distribution, and in this particular this is one of the most satisfactory floras ever published in this country.

The book contains about three hundred pages, exclusive of the very full indexes. It deals with the spermatophytes only, the ferns not being included, so that the word 'flora' is strictly proper as applied to the book. It includes 2,201 species, representing 655 genera, 156 families and 43 orders. It is a great and enduring monument to the industry and ability of the author.

Charles E. Bessey.

University of Nebraska.

*AGRICULTURE IN JAPAN.**

Only 14,995,272 acres, or 15.7 per cent. of the whole area of Japan, exclusive of Formosa, consists of arable land, and 55 per cent. of the agricultural families cultivate less than 2 acres each; 30 per cent. cultivate 2 acres or more up to 1½ cho, or a little less than 3¾ acres, leaving 15 per cent. of the farmers who cultivate farms of 3¾ acres or more. A comparison of the whole area under cultivation with the number of farm workers shows that, on an average, one man cares for a little less than an acre.

The government has attempted to aid the progress of agriculture by laws respecting irrigation, the protection of forests so as to control the flow of rivers in the interest of the farmer, the formation of farmers' guilds, the rearrangement of farm boundaries, and the improvement of drainage systems. Small as the farms are, their parts are usually separated so that a farm of 2 acres may consist of several nonadjacent lots, the average size of a lot being about one eighth of an acre. A law which went into force in 1900 provides for the rearrangement of boundaries by farmers exchanging fields for those owned by others so as to make the farms more compact and enlarge the fields to permit the use of horses and machinery, at the same time increasing the tillable area by straightening some boundaries and removing others. About 20,000 acres have already come under the operation of this law.

For the purpose of further promoting agricultural interests the government maintains a State experimental farm and nine branch farms. The work at these farms is largely theoretical, and is divided into eight departments, viz., seed, saplings, agricultural chem-

* Consular report from United States Consul-General Bellows, Yokohama, Japan.

istry, entomology, vegetable physiology, tobacco, horticulture, and general affairs. The results of the investigations are submitted to thirty-eight experimental farms, created and carried on by the provinces with the help of a subsidy from the general government, and theories are here subjected to the test of practical application before general publication. Among the results already accomplished by this method are improvement in the quality and quantity of crops through more careful selection of seeds and better understanding of the varieties suited to the conditions in different localities; more efficient modes of destroying injurious insects; ability to minimize the injury from plant diseases, such as smut, mildew, pear cluster-cups, etc.; increased skill in the application of fertilizers, and the discovery of indigenous grasses suitable for meadows, all meadow grasses having formerly been imported.

The general government aids the local treasuries to maintain six local agricultural schools for the instruction of farmers' sons in the general principles of agriculture, surveying, veterinary science, and related subjects. The government also carries on an experimental tea farm, on which is a curing workshop; a laboratory for investigating the disease of cattle and poultry; a cattle-breeding pasture for improving the native breeds of cattle for meat and dairy purposes, and two horse-breeding pastures for promoting the introduction of better horses.

Efforts have been made to introduce sheep raising and swine raising, but with only partial success. It is claimed that the conditions of climate and food supply present no serious obstacle to the success of sheep farming, but the statistics of 1901 showed only 2,545 sheep in the country. Swine raising has succeeded better, but can not yet be spoken of as an established industry of much importance, the number of swine having remained in the vicinity of 200,000 for several years.

The principal agricultural products, named in the order of their acreage, are rice, rye, barley, wheat, beans, mulberries, sweet potatoes, millet, buckwheat, rape, red beans, Italian millet, tea, indigo leaves, potatoes, sorghum, tobacco leaves, cotton and hemp. The area devoted to rice cultivation constitutes a little more than two fifths of the total area of arable land. The greater part of the rice fields are in low-lying land, which can be easily flooded, but some upland rice is raised. Mulberry trees and tea plants are usually planted on land not suitable for more important crops, such as the slopes of hills, sandy dunes, and similar places. In the warmer parts of the Empire barley and rape are often raised as a second crop after rice has been harvested, but farther north the excess of moisture required for rice leaves the land too cold for another crop the same year.

Stock raising is still in its infancy in Japan, and is not likely to become an important industry, owing to the high price of land and the coarseness of the native grasses, most of which are not fit for food for cattle or horses. Oats and maize as foods for farm animals are practically unknown, and what passes for hay is a kind of straw, which is chopped fine before it is fed to horses. A little less than one sixth of the arable land consists of plains and pastures, and of this about two fifths belong to the state and the imperial household, the remainder being owned by private stock raisers, who raise stock principally for tillage and draft animals. The natives are not accustomed to the use of butter or milk, and do not usually like the taste of them, and their religious prejudices have hitherto prevented the general use of meat of any kind, although they now seem to be developing a taste for all these kinds of food.

Farmers do not engage in poultry raising to a sufficient extent to provide the eggs needed for home consumption, these being imported from China to the value of over $500,000 per year. Fruit raising, under the stimulus of government encouragement, has advanced considerably, but is not yet an important branch of farming in this country. Bee culture is engaged in to a limited extent, but the industry is still in a primitive condition.

THE URBAN AND RURAL POPULATION OF GREAT BRITAIN.

THE general report of the census of Great Britain of 1901 has recently been issued. In

commenting on this report the London *Times* says:

"Attention has been prominently directed, by the report of the Committee on Physical Deterioration, to what is there described as the 'urbanization' of the people; and hence few portions of the volume now issued will be of more general interest than those which set forth the extent to which this process is actually being carried on. We find, in the first place, that the population has decreased in the five English counties of Huntingdonshire, Nottinghamshire, Westmoreland, Oxfordshire and Herefordshire, and in the five Welsh counties of Montgomeryshire, Cardiganshire, Flintshire, Merionethshire and Brecknockshire; the decrease ranging from 7.04 per cent. in Huntingdonshire to 1.62 per cent. in Herefordshire; and from 5.08 per cent. in Montgomeryshire to 0.17 per cent. in Brecknockshire. In the remaining forty-five English and Welsh counties there was an increase of population, ranging from 45.11 per cent. in Middlesex to 0.003 per cent. in Cornwall; but the increase in Radnorshire, which was only apparent, and is said to have veiled a real decrease, was due to the presence in the county of a number of men who were temporarily engaged in the construction of waterworks for the Corporation of Birmingham. Particulars are given for 1,122 urban and for 664 rural districts, and it appears that the aggregate population of the former in 1901 was 25,058,355, and of the latter, constituting the remainder of the country, 7,469,488; so that the persons enumerated in urban were to those enumerated in rural districts as 335 to 100; the proportions in 1881 and in 1891, in the urban and rural districts as constituted at those periods, having been respectively 212 and 258 to 100. The increase in the proportion resident in urban districts is attributed partly to an actual growth of population within those districts as they existed in earlier census years and partly to the growth of the districts themselves through the absorption of areas which were previously rural. It was pointed out in 1891, and is still the case, that a considerable number of the urban districts, although technically urban, are distinctly rural in character, being in many cases small towns situated in the midst of agricultural areas on which they are dependent for their maintenance as business centers. At the recent census there were 215 urban districts with populations below 3,000, 211 with populations between 3,000 and 5,000, and 260 with populations between 5,000 and 10,000; and the report follows the example of its predecessor in stating the proportions between urban and rural dwellers from these three points of view. If we class with the rural districts all those urban districts with populations below 10,000, the aggregate population of the remaining urban areas numbered 21,959,998, the population of the same areas in 1891 having been 18,964,882, and the rate of increase in the decennium being 15.8 per cent. In the rural areas, with the added small urban districts, the population increased from 10,037,643 in 1891 to 10,567,845 in 1901, or an increase of 5.3 per cent. There are, nevertheless, many rural parts in which actual depopulation has occurred, and these are found in the rural and small urban districts of twenty-three counties; while, although there has been a small increase of population in rural areas in the aggregate, there has, nevertheless, been a very considerable drain on the natural growth of the population of these areas. A table is given showing that, in a rural population of nearly five and a half millions, the natural growth by excess of births over deaths was 565,253 in the ten years preceding the census of 1901, but that the actual increase of population was only 64,599, showing a loss by migration of 500,654, equal to 9.1 per cent. of the population of 1891."

THE CARNEGIE TRUST FOR THE UNIVERSITIES OF SCOTLAND.

The Carnegie Trust for the universities of Scotland has made awards for the year 1904–5 of twenty-four scholarships, twelve fellowships and thirty-five special grants, the total value of which is somewhat more than $25,000. The fellows are as follows:

Physical.—(1) Dugald B. McQuistan, M.A., B.Sc., Glasgow.

Chemical.—(2) Charles E. Fawsitt, B.Sc., Edinburgh (second year); (3) James C. Irivine, B.Sc., D.Sc., St. Andrews (second year); (4) William Maitland, B.Sc., Aberdeen (second year).

Biological.—(5) John Cameron, M.B., Ch.B., Edinburgh (second year); (6) Francis H. A. Marshall, B.A., Cambridge, D.Sc., Edinburgh; (7) Henry J. Watt, M.A., Aberdeen.

Pathological.—(8) Carl H. Browning, M.B., Ch.B., Glasgow; (9) John C. G. Ledingham, M.A., B.Sc., M.B., Ch.B., Aberdeen; (10) S. A. K. Wilson, M.A., M.B., Ch.B., Edinburgh.

Historical.—(11) Richard Bell, M.A., B.D., Edinburgh; (12) Duncan MacKenzie, M.A., Edinburgh (second year).

Grants for research are made as follows:

Physical.—(1) George A. Carse, M.A., B.Sc., Edinburgh; (2) Professor MacGregor, Edinburgh University; (3) Thomas Oliver, B.Sc., Edinburgh; (4) William Peddie, B.Sc., lecturer in natural philosophy, Edinburgh University.

Chemical.—(5) Professor G. G. Henderson and Dr. Gray, Glasgow and West of Scotland Technical College (second year); (6) A. N. Meldrum, D.Sc., assistant in chemistry, Aberdeen University (second year).

Biological.—(7) James H. Ashworth, D.Sc., assistant in zoology, Edinburgh University (second year); (8) John Beard, D.Sc., lecturer in embryology and invertebrate zoology, Edinburgh University (second year); (9) Cyril Crossland, B.A., B.Sc., assistant in zoology, St. Andrews University; (10) Professor J. Cossar Ewart, M.D., Edinburgh University (second year); (11) Professor Paterson, West of Scotland Agricultural College, Glasgow; (12) John Rennie, D.Sc., assistant in zoology, Aberdeen University (second year); (13) William G. Smith, B.Sc., St. Andrews; (14) David Waterston, M.A., M.D., assistant in anatomy, Edinburgh University (second year); (15) John H. Wilson, D.Sc., St. Andrews (second year); (16) Professors R. Patrick Wright and A. N. M'Alpine, West of Scotland Agricultural College, Glasgow.

Anatomical.—(17) Edward B. Jamieson, M.B., Ch.B., demonstrator of anatomy, Edinburgh University.

Pharmacological.—(18) Professor R. Stockman, Glasgow University.

Pathological.—(19) James Kerr Love, M.D., Glasgow (second year); (20) Edwin Bramwell, M.B., F.R.C.P.E., Edinburgh; (21) Professor Carstairs C. Douglas, B.Sc., M.D., Anderson's College Medical School, Glasgow (second year); (22) Alexander H. Edwards, M.B., C.M., Edinburgh (second year); (23) Alexander Goodall, M.D., Edinburgh (second year); (24) J. M. Kirkness, M.B., Ch.B., Edinburgh; (25) Professor Robert Muir, M.D., Glasgow University (second year); (26) Peter Paterson, M.B., assistant in surgery, Glasgow University; (27) W. B. Inglis Pollock, M.B., Ch.B., Glasgow; (28) Benjamin P. Watson, M.B., Ch.B., Edinburgh; (29) John M. Bowie, M.D., Edinburgh; (30) James Scott, M.D., Edinburgh (second year); (31) Douglas Chalmers Watson, M.B., F.R.C.P.E., Edinburgh.

Historical.—(32) William Cramond, M.A., LL.D., Aberdeen (second year); (33) Professor W. M. Ramsay, M.A., D.C.L., LL.D., Litt.D., Aberdeen University (second year).

Economical.—(34) William R. Scott, M.A., D.Phil., lecturer in political economy, St. Andrews University.

Linguistic.—(35) Kenneth MacKenzie, M.A., Glasgow.

SCIENTIFIC NOTES AND NEWS.

DR. HERMANN KNAPP, emeritus professor of ophthalmology in Columbia University, has celebrated at Giessen the fiftieth anniversary of his doctorate, when the diploma was renewed.

ALBERT VON REINACH, the geologist of Frankfort on Maine, has been made an honorary doctor of philosophy by the University of Marburg.

PROFESSOR V. M. SPALDING has resigned the chair of botany in the University of Michigan. His address after October 15 will be Tucson, Arizona, where he will continue his work begun last year at the Desert Laboratory.

PROFESSOR W. H. PICKERING, of Harvard University, is at present at Mt. Lowe Observatory, California, continuing his observations on the moon.

DR. J. WESLEY HOFFMANN is here studying the cultivation of cotton on behalf of the British government.

PROFESSOR MELVILLE T. COOK, of the department of biology at De Pauw University of Indiana, has been made chief plant pathologist by the Cuban government.

DR. SIDNEY D. WILGUS, of New York City, has been appointed by the State Commission in Lunacy as chief examiner, under the law passed by the last legislature creating a state board of alienists.

Dr. George F. Shrady, who has been editor of the *Medical Record* since its establishment thirty-eight years ago, has retired and is succeeded by Dr. Thomas L. Stedman.

The Middlemore prize of the British Medical Association for the best original work on ophthalmology during the past two years has been awarded to Mr. J. H. Parsons.

The Academy of Sciences, Berlin, has made a number of subsidies including 2,300 Marks to Professor Adolf Engler for the continuation of his work, 'Das Pflanzenreich'; 1,020 Marks to Dr. Emil Warburg for his investigation on the specific heat of gases at high temperatures, and 1,000 Marks to Professor Walter Kaufmann for investigations on electrons.

Dr. Judson F. Clark, of the Bureau of Forestry and instructor in the New York State College of Forestry at the time of its discontinuance, has been appointed provincial forester of Ontario.

Dr. Hans Battermann, astronomer at the Berlin Observatory, has been made director of the observatory and professor of astronomy at Königsberg.

Captain Arthur Mostyn Field, R.N., has been selected for the appointment of hydrographer of the British navy on the retirement of Rear-Admiral Sir William J. L. Wharton, K.C.B., F.R.S.

A committee has been formed in Bourg to erect a monument in memory of the astronomer Jerome Lalande.

The British Medical Journal reminds us that July twentieth was the hundredth anniversary of the birth of Sir Richard Owen at Lancaster, where an inscription on a house in Thurnham Street records the place of his birth.

Dr. Franz Hilgendorf, curator in the Museum of Natural History of Berlin, died on July 6, at the age of sixty-four years.

By the will of the late Frances Skinner Willing, of Chicago, the Mark Skinner Library at Manchester, Vt., will receive $40,000 as an endowment fund.

There will be a civil service examination on September 7, to fill a vacancy in the position of laboratory assistant in pharmacology in the Bureau of Plant Industry, Department of Agriculture, at $750 per annum.

Representatives of the principal South American states met at Rio Janeiro from June 5 to 12, to consider measures of sanitary prophylaxis.

Seventy-four members of the British Institution of Electrical Engineers have signified their intention of attending the Electrical Congress at St. Louis. Among them are the president, R. J. Gray Esq., Professor John Perry and Dr. R. T. Glazebrook.

The American Neurological Association will hold its next annual meeting at St. Louis, on September 15, 16 and 17, 1904, under the presidency of Dr. James W. Putnam, of Boston.

Nature states that arrangements have been made which will make it unnecessary to close the Museum of Practical Geology, Jermyn Street, for a month in autumn as heretofore; the museum will therefore remain open to students and visitors daily.

The Ziegler relief expedition arrived at Vardo, Norway, on board the *Frithjof*, on July 3, on its return from the north. Owing to ice and fog it did not succeed in reaching the *America*, having on board the Ziegler-Fiala arctic expedition. The *Frithjof* will sail north again as soon as possible.

We learn from *Nature* that the following excursions have been arranged in connection with the Cambridge meeting of the British Association which opens on August 17:

Audley End and Saffron Walden.—Audley End House will be visited by permission of the Lord Howard de Walden; the church and museum in Saffron Walden form other items in the program.

Brandon and Didlington Hall.—The most attractive features of this excursion will be the flint knapping industry at Brandon, Lord Amherst's Egyptian collections, rare books and illuminated MSS. at Didlington Hall.

Cromer.—Mr. Clement Reid, F.R.S., has arranged an attractive itinerary for those interested in the geology of the Norfolk coast.

Dykes of Cambridge.—This excursion includes an inspection of the well-known Fleam Dyke and Devil's Ditch, under the guidance of Professor

Ridgeway; opportunity will also be afforded for botanizing on the dykes. By the invitation of Mr. Richard Marsh, trainer to H. M. the king, tea will be provided at Egerton House, Newmarket.

Ely.—A visit to the cathedral, a building of exceptional architectural interest, under the guidance of the dean, forms the most important feature of this excursion.

Wicken Fen and Upware.—Members will travel from Cambridge to Upware in steam launches. This excursion is likely to be of considerable interest to geologists, entomologists and botanists.

Hatfield and St. Albans.—A visit to Hatfield House, by permission of the Marquis of Salisbury, visits to St. Albans Abbey, the site of Verulam, the sites of the battlefields of St. Albans, and the orchid houses of Messrs. Sanders, form the chief attractions.

Lincoln.—The exceptional architectural and archeological features of Lincoln seemed to the committee sufficient justification for arranging an excursion to this city, in spite of its distance from Cambridge. The mayor of Lincoln invites members to tea in the Castle grounds.

Norwich.—The cathedral, the hospital of St. Giles, and St. Andrew's Hall are the most important buildings to be visited. Hospitality is offered by the mayor of Norwich, and by Mr. and Mrs. James Stuart.

Sandringham, Lynn and Castle Rising.—This excursion, which is likely to prove one of the most popular, includes visits to the Lynn churches, the castle and church at Castle Rising, also the grounds, kennels, stables and dairy at Sandringham. Tea will be provided by invitation of H. M. the king.

Wisbech.—The lord lieutenant of Cambridgeshire has kindly invited members of the association to visit the old-world town of Wisbech, and facilities will also be afforded for inspecting the woad works.

ACCORDING to *Nature* the new hall of the Royal Horticultural Society in Vincent Square, Westminster, was opened on July 22. The building, which includes a library, offices, council chambers, and a lecture room, in addition to the large hall in which the society will hold its fortnightly exhibitions, has been built to celebrate the centenary of the society. In the address which Sir Trevor Lawrence read to the King and Queen the work of the Royal Horticultural Society was reviewed, and in regard to the efforts of the collectors sent out by the society in the nineteenth century, it was said, in the words of Mr. Andrew Murray, that "the results have affected the appearance of all England. Nowhere can a day's ride now be taken where the landscape is not beautified by some of the introductions of the Royal Horticultural Society." Perhaps nothing indicates more clearly the way in which the society has promoted the science and art of horticulture than the fact that whereas there were one thousand three hundred fellows in 1887, there are now eight thousand, one hundred and fifty. Baron Sir Henry Schroeder presented the report of the building and appeal committees, in which it was stated that twenty-six thousand pounds had been subscribed towards the cost of the hall, which will amount in the end to forty thousand pounds. It is the intention of the society to provide scientific instruction as well as practical training in connection with the gardens at Wisley.

WE learn from *Forestry and Irrigation* that a new classification of technical grades in the Bureau of Forestry went into effect July 1. This change was made in order to provide a set of generic titles that would tell more clearly what its men are doing. The titles are more easily distinguished, are more dignified, and mean more to the men themselves. The new grades with the yearly salaries they carry are:

Forester, $3,500.

Associate Forester, $2,700 to $3,000.—Chief of the ranking division and assistant to the Forester.

Assistant Forester, $2,100 to $2,600.—Chiefs of divisions and men occupying positions of similar responsibility.

Forest Inspector, $1,800 to $2,000.—Chiefs of the ranking sections of divisions and men in charge of independent lines of work of similar importance.

Assistant Forest Inspector, $1,500 to $1,700.—Chiefs of sections of divisions, except of the ranking section, and men occupying positions of similar responsibility.

Forest Assistant, $900 to $1,400.—Men who enter the Bureau through the examination for Forest Assistant and have not yet been given charge of independent lines of work.

Forest Agent, $700 to $900.—Men without civil-service standing, in charge of subordinate lines of work.

Forest Student, $300.—Men whose service is temporary and educational in character and whose training in forestry is incomplete.

Nature learns from the *Bulletin* of the Russian Society of Naturalists of St. Petersburg that the biological station which has been established near Alexandrovsk, on the Norman coast of the Kola peninsula, is now in working order. It is provided with all the necessary apparatus for pumping sea-water to a basin and an aquarium, as well as with a special sailing boat and all apparatus required for fishing and dragging.

On the occasion of the meeting of the British Medical Association, Oxford University conferred the degree of D.Sc. on a number of visiting physicians, including Professor William Osler, of the Johns Hopkins University. Professor Love, Sedlian professor of natural philosophy, presented the recipients, making remarks in Latin. According to the translation in *The British Medical Journal*, he said of Professor Osler: "Among those who apply the results of modern science to the investigation of the causes and the cure of diseases, few have attained greater distinction than William Osler. By his professional teaching, first in Montreal and afterwards in Baltimore, by his writings, which deal partly with questions of abstract science and partly with questions concerning the practise of medicine, by his skill as a physician, he has been for many years a leading exponent of the principle that the art of medicine should be based upon the most exact scientific knowledge of the day. For his work in exemplifying this principle, as well as for the merit of his contributions to science, he was elected a fellow of the Royal Society. In him also we welcome a representative of one of those daughter states which are the pride of the mother country—the Dominion of Canada—and also of that great republic of the west whose people, bound to us by the closest ties of kinship, are also among our best friends."

UNIVERSITY AND EDUCATIONAL NEWS.

The New York *Evening Post* states that the College of Physicians and Surgeons, Columbia University, has received a bequest of $10,000 by the will of Mrs. Eleanor Cooper.

Dr. Brown Ayres, professor of physics in Tulane University, has been elected president of the University of Tennessee.

Professor George M. Duncan has, according to the daily papers, resigned his professorship of philosophy at Yale University. Professor G. T. Ladd, it will be remembered, presented his resignation last spring, to take effect at the end of the next academic year. Professor Hershey E. Sneath, who has hitherto held the chair of ethics, has been transferred to the department of pedagogy.

Dr. Henry J. Prentiss, professor of practical anatomy, University and Bellevue Hospital Medical College, has accepted the chair of anatomy at the University of Iowa, made vacant by the death of Dr. J. W. Harriman.

Miss D. L. Bryant, S.B., of the department of geology, '91 of the Massachusetts Institute of Technology, received the degree of Doctor of Philosophy, June 30, 1904, at Erlangen, with the distinction of *magna cum laude*. After graduating from the institute she taught geology at Greensboro, N. C., and before leaving for Europe she took a course in petrography with Dr. Van Hise, at Madison, Wisconsin. She has since studied at Heidelberg, and for the past two years at Erlangen. Her graduating dissertation was upon 'The Petrography of Spitzbergen.'

Miss Marion Stopes, Ph.D., has been appointed junior professor of botany in the University of Manchester.

Dr. William Palmer Wynne has been elected professor of chemistry in University College, Sheffield.

Dr. L. Gerlach, professor of anatomy at Erlangen, has been made rector for the coming academic year.

Dr. Hippolyt Haas, professor of geology at Kiel, has retired from active service.

Professor L. Busse, of Königsberg, has been called to a professorship of philosophy at Münster, in succession to Professor E. Addickes, who has been appointed professor at Tübingen.